CLAIMS

We claim:

1. A polymeric drug delivery system, comprising:

(a) a biodegradable water insoluble polymer that is a solid or wax at 37°C;

(b) a biodegradable water soluble polymer that is a liquid at 25°C; and

(c) a hydrophobic drug, wherein said polymeric drug delivery system is a liquid or paste at 25°C.

2. The polymeric drug delivery system of claim 1 wherein said water insoluble polymer is a polymer selected from the group consisting of polylactic acid, polyglycolic acid, polycaprolactone, polyanhydride, polybutyric acid, polyacrylic acid, and polymethacrylate.

3. The polymeric drug delivery system of claim 1 wherein said water insoluble polymer is a block copolymer, said block copolymer comprising a block selected from the group consisting of polylactic acid, polyglycolic acid, polycaprolactone, polyanhydride, polybutyric acid, polyacrylic acid, and polymethacrylate.

4. The polymeric drug delivery system of claim 3 wherein said block copolymer comprises a hydrophilic block selected from the group consisting of polyalkylene oxide and polysaccharide.

5. The polymeric drug delivery system of claim 3 wherein said water insoluble polymer is a triblock copolymer having the formula ABA, wherein each A is a hydrophobic block, and wherein B is a hydrophilic block.

6. The polymeric drug delivery system of claim 5 wherein said hydrophobic block is a polyester.

7. The polymeric drug delivery system of claim 6 wherein said polyester is a poly(α-hydroxy acid).

8. The polymeric drug delivery system of claim 7 wherein said poly(α-hydroxy acid) is poly(glycolic acid) or poly(lactic acid).

9. The polymeric drug delivery system of claim 6 wherein said hydrophilic block is a polyalkylene oxide.

10. The polymeric drug delivery system of claim 9 wherein said polyalkylene oxide is polyethylene glycol.

11. The polymeric drug delivery system of claim 9 wherein said polyester and said polyalkylene oxide components of said triblock copolymer are linked by caprolactone links.

12. The polymeric drug delivery system of claim 11 wherein said triblock copolymer comprises [poly(DL-lactide-co-ε-caprolactone)]-[polyethylene glycol]-[poly(DL-lactide-co-ε-caprolactone)].

13. The polymeric drug delivery system of claim 1 wherein said water soluble polymer is polyethylene glycol or methoxypolyethylene glycol.

14. The polymeric drug delivery system of claim 12 wherein said water soluble polymer is methoxypolyethylene glycol having a number average molecular weight of about 100-500.

15. The polymeric drug delivery system of claim 14 wherein said triblock copolymer (TB) and said methoxypolyethylene glycol (MePEG) are present in said polymeric drug delivery system at a weight ratio of TB:MePEG within the range of 30:70 to 90:10.

16. The polymeric drug delivery system of claim 1 wherein said water insoluble polymer is a triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the triblock copolymer is a liquid at a temperature within the range of 25-40°C.

17. The polymeric drug delivery system of claim 1 wherein said water insoluble polymer is a triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after the polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the copolymer is a paste at a temperature within the range of 25-40°C.

18. The polymeric drug delivery system of claim 1 wherein said water insoluble polymer is a triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after the polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the copolymer is not a solid at 25°C.

19. The polymeric drug delivery system of claim 1 wherein the weight of said hydrophobic drug represents a percentage of the total weight of said polymeric drug delivery system within the range of 2-30%.

20. The polymeric drug delivery system of claim 1 wherein said hydrophobic drug is selected from the group consisting of amphotericin, anthralin, beclomethasone, betamethasone, camptothecin, curcumin, dexamethasone, indomethacin, genistein, lidocaine, insulin, nystatin, paclitaxel, tetracycline, tretinoin, cromoglycate, levobunolol, and terbinafine.

21. The polymeric drug delivery system of claim 20 wherein said hydrophobic drug is selected from the group consisting of paclitaxel, camptothecin, amphoterecin, nystatin, tretinoin, genistein, and curcumin.

22. The polymeric drug delivery system of claim 20 wherein said hydrophobic drug is paclitaxel.

23. The polymeric drug delivery system of claim 1, comprising at least two drugs.

24. A method for delivering a drug to a subject, comprising the administration of a polymeric drug delivery system that comprises (a) a biodegradable water insoluble polymer that is a solid or wax at 37°C, (b) a biodegradable water soluble polymer that is a liquid at 25°C, and (c) a hydrophobic drug, wherein said polymeric drug delivery system is a liquid or paste at 25°C.

25. The method of claim 24 wherein said polymeric drug delivery system is administered to said subject by a method selected from the group consisting of intraperitoneal injection, intraarticular injection, intraocular injection, intratumoral injection, perivascular injection, subcutaneous injection, intracranial injection, and intramuscular injection.

26. The method of claim 24 wherein said polymeric drug delivery system is administered to said subject by application on a surgically exposed tissue.

27. The method of claim 24 wherein said polymeric drug delivery system is administered to said subject by a mode selected from the group consisting of periophthalmic application, administration inside the eyelid, intraoral administration, intranasal administration, intrabladder administration, intravaginal administration, intraurethral administration, intrarectal administration, and application to the adventitia of an internal organ.

28. The method of claim 24 wherein said subject is a mammal.

29. The method of claim 28 wherein said mammal is a human.

30. The method of claim 28 wherein said mammal is a farm or domestic animal.

31. A method of preparing a polymeric drug delivery system, comprising the blending of: (a) a biodegradable water insoluble polymer that is a solid or wax at 37°C, (b) a biodegradable water soluble polymer that is a liquid at 25°C, and (c) a hydrophobic drug, wherein said polymeric drug delivery system is a liquid or paste at 25°C.

32. The method of claim 31 wherein said hydrophobic drug is not mixed with an organic solvent prior to said blending step.

33. A triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after the polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the copolymer has a consistency, at a temperature within the range of 25-40°C, selected from the group consisting of a paste and a liquid, or has a non-solid consistency at 25°C.

34. The copolymer of claim 33 wherein block A consists essentially of residues having the structure resulting from the polymerization of monomers selected from the group hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid.

35. The copolymer of claim 33 wherein block A comprises residues having the structure resulting from the polymerization of 2-hydroxypropionic acid.

36. The copolymer of claim 33 wherein block A consists essentially of residues having the structure resulting from the polymerization of 2-hydroxypropionic acid.

37. The copolymer of claim 33 wherein block A comprises residues having the structure resulting from the polymerization of 6-hydroxyhexanoic acid.

38. The copolymer of claim 33 wherein block A comprises residues having the structure resulting from the polymerization of 2-hydroxypropionic acid and 6-hydroxyhexanoic acid.

39. The copolymer of claim 33 wherein block A consists essentially of residues having the structure resulting from the polymerization of 2-hydroxypropionic acid and 6-hydroxyhexanoic acid.

40. The copolymer of claim 33 wherein block A contains residues having the structure resulting from the polymerization of 2-hydroxypropionic acid and 6-hydroxyhexanoic acid in a 2-hydroxypropionic acid:6-hydroxyhexanoic acid weight ratio of 40-60:60-40.

41. The copolymer of claim 33 wherein the A block is a random copolymer.

42. The copolymer of claim 33 wherein block B comprises residues having the structure resulting from the polymerization of ethylene oxide.

43. The copolymer of claim 33 wherein block B is a CDC triblock copolymer wherein C and D are selected from homopolymers of ethylene oxide and propylene oxide.

44. The copolymer of claim 33 wherein block B has a number average molecular weight of less than or equal to 8,000.

45. The copolymer of claim 44 wherein the molecular weight is less than or equal to 1,000 and at least 100.

46. The copolymer of claim 33 wherein the B block provides 10-50% of the weight of the copolymer.

47. The copolymer of claim 33 wherein at least 50% of the copolymer is biodegradable.

48. A drug delivery system comprising a drug in combination with a triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after the polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the copolymer has a consistency, at a temperature within the range of 25-40°C, selected from the group consisting of a paste and a liquid, or has a non-solid consistency at 25°C.

49. The drug delivery system of claim 48 wherein the drug is selected from a peptide, protein, antigen, vaccine, anti-infective, antibiotic, antimicrobial, antiallergenic,

steroid, decongestant, miotic, anticholinergic, sympathomimetic, sedative, hypnotic, psychic energizer, tranquilizer, analgesic, antimalarial and antihistamine.

50. The drug delivery system of claim 48 wherein the drug is paclitaxel.

51. The drug delivery system of claim 48 wherein the drug provides 0.1% to 10% of the total weight of the system.

52. A method of administering a drug to a subject comprising contacting the subject with a drug delivery system comprising a drug in combination with a triblock copolymer of the formula ABA, wherein A is a block of residues comprising residues which remain after polymerization of one or more monomers selected from the group consisting of hydroxyacetic acid, 2-hydroxypropionic acid and 6-hydroxyhexanoic acid, B is a block of residues comprising residues which remain after the polymerization of one or more monomers selected from the group consisting of alkylene oxide and alkylene glycol, and the copolymer has a consistency, at a temperature within the range of 25-40°C, selected from the group consisting of a paste and a liquid, or has a non-solid consistency at 25°C.

53. The method of claim 52 wherein the drug delivery system is injected directly into a solid tumor of the subject.

54. The method of claim 52 wherein the drug delivery system is applied to a tumor resection cavity.

55. The method of claim 52 wherein the tumor resection cavity contains cancer cells.

56. The method of claim 52 wherein the drug kills cancer cells.

57. The method of claim 52 wherein the drug delivery system is topically applied to tissue of the subject.

58. The method of claim 52 wherein the drug prevents post-surgical adhesion.

59. The method of claim 52 wherein the drug delivery system is applied perivascularly to the subject.

60. The method of claim 52 wherein the drug treats restenosis.

61. The method of claim 52 wherein the drug delivery system is injected intra-articularly to the subject.

62. The method of claim 52 wherein the drug treats arthritis.